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# AMERICAN JOURNAL OF OPTOMETRY *and* ARCHIVES *of* AMERICAN ACADEMY OF OPTOMETRY


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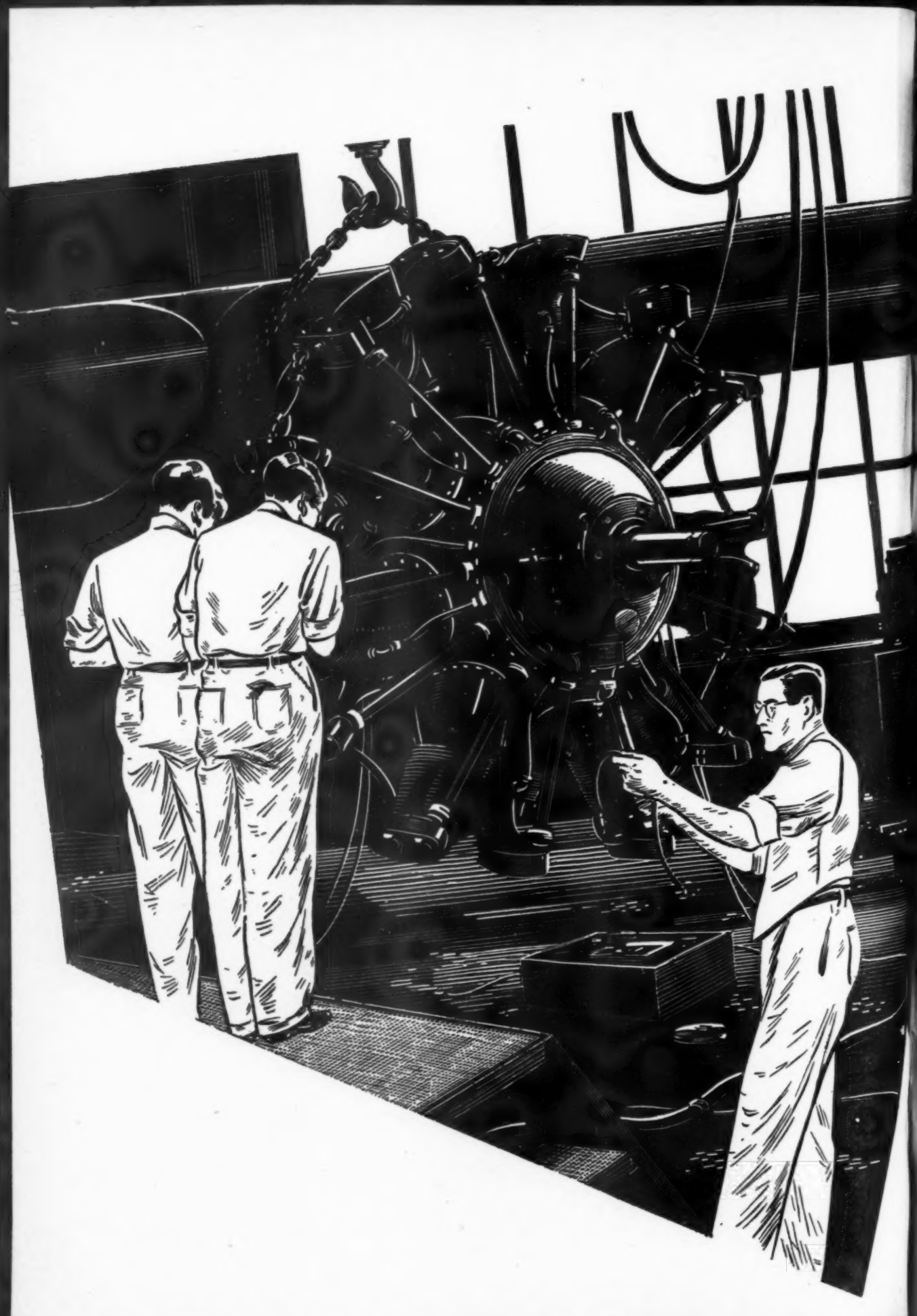

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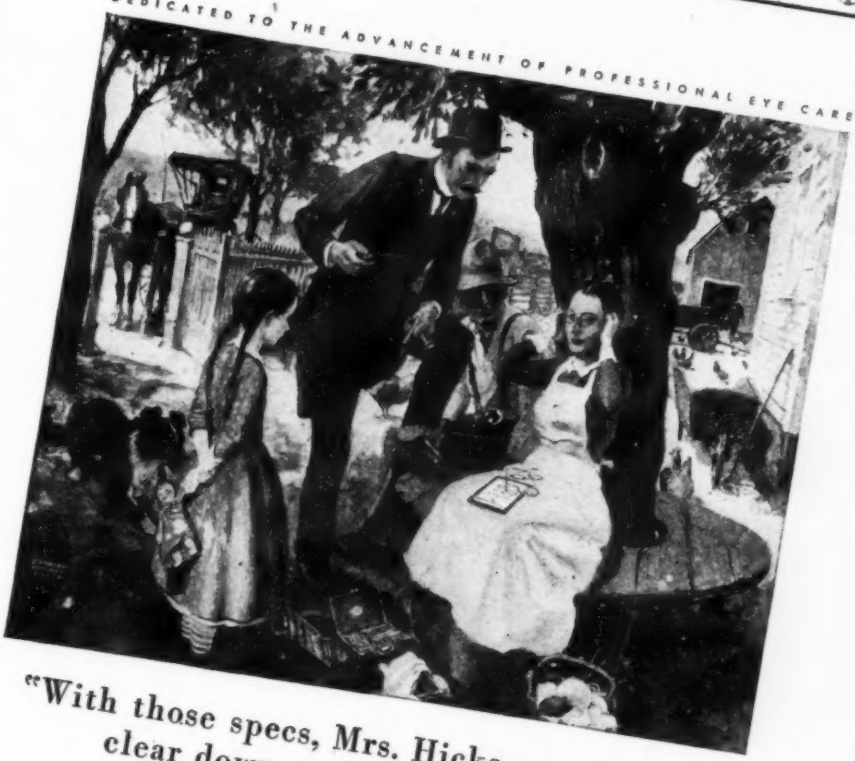

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*From the AMERICAN Plan

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*This advertisement has appeared in Life, and during September is scheduled for: Saturday Evening Post (September 12), Look (September 22), and the October issue of Good Housekeeping, on newsstands September 20.*

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AMERICAN JOURNAL OF OPTOMETRY
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# A PLAN FOR REFRACTIVE EYE CARE FOR THE INDIGENT AND THE MEDICALLY INDIGENT IN MINNESOTA*

## PART II. THE PLAN, THE PROPOSAL, AND APPENDIX: INCLUDING THE ADOPTION OF A STATE WIDE PROGRAM OF REFRACTIVE EYE CARE

Carel C. Koch, Opt.D., F.A.A.O.
Minneapolis, Minn.

### THE PLAN

*The Minneapolis Eye-Refraction Panel, a fore-runner of the County Panel.*

An eye-refraction panel composed of Minneapolis optometrists was created the Spring of 1939, after a conference, at which relief authorities, social workers and optometrists considered refractive problems. This panel, originally composed of 27 Minneapolis optometrists, was approved by the Minneapolis Board of Public Welfare and has been doing refractive work on a fee basis for relief clients of the city since that time. The local ophthalmological group also submitted a panel list which was also approved by the Board and relief clients are now given a free choice of doctor for refractions, from the joint list.

To be eligible for Minneapolis panel service an optometrist's educational qualifications are certified by the Minneapolis District Optometric Association. In addition, the optometrist must be practicing ethically in an office, and be properly equipped with modern instruments to do a thorough piece of ocular diagnostic and refractive work. He also must carry adequate coverage of mal-practice insurance. The same regulations apply to eye physicians who receive the same compensation for similar refractive work as do the optometrists.

This is mentioned at this time because it has a bearing upon the action taken by the executive committee of the Minnesota State Opto-

*An abridgment of the material presented before the American Academy of Optometry, at Chicago, Illinois, December 7, 1941, for publication in the September, 1942, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY. The material appearing in the Appendix was not presented at Chicago. Part I of this report, "The Problem and the Assembling of Data," appeared in the August issue.

metric Association in their studies of the entire health question and in their deliberations and planning for the state as a whole.

While insisting from the start that every optometrist be eligible in this, and other state-wide programs, it was evident that standards of practice play an important part in participation in public health work and that *real* optometric participation would depend, in part at least, upon the type of personnel *recommended* to city or county relief authorities for their use.

This being true, the Minnesota State Optometric Association decided upon a policy somewhat similar to that of the Minneapolis District Optometric Association in selecting its recommended panel representatives. For the state as a whole it was decided that the optometrist must be properly equipped and also be practicing exclusively and ethically, and that he have the type of undergraduate and graduate training which would make it possible for his state association to certify and recommend his services.

Before any detailed planning was attempted however, on the part of the executive committee of the Minnesota State Optometric Society, much information relative to refractive work was compiled for each county.

*The development of the County Eye-Refraction Panels.*

In rural areas most relief clients have automobiles.* They are used continuously in their daily activities and these persons are accustomed to drive considerable distances to have their wants supplied, frequently crossing county lines to accomplish this.

Eye-Refraction panels for any given county must therefore take this into consideration.

Furthermore, it frequently happens that those recommended optometrists, with panel qualifications, are more or less bunched at one end of a county, therefore being at some considerable distance from relief clients who reside in townships at the other end of the county. These latter persons frequently do all of their trading at some nearby town across the county line and would be inconvenienced if they were required to travel entirely across the county to visit an optometrist within their own county area. For this reason each county panel must include

*A pre-war statement of fact. The reader should remember that this portion of this report was compiled and written during April, May and June, 1941.

(1) all eligible optometrists who practice in the county and (2) those eligible optometrists in the immediate trade area of all parts of the county thereby offering maximum convenience and as free choice of doctor as possible.

This type of panel development naturally results in some duplication. Certain optometrists are, in this manner, placed upon as many as five or six county panels, depending upon their location. All optometrists, who qualify for panel work and who practice in rural areas find themselves on at least three county panels.

Because of natural jealousies, no optometrists from very large urban centers are placed on rural county panels. The names of men from Minneapolis and St. Paul are to be found only on the county panel of the particular county in which their city is located.

This entire technique of county panel building is well illustrated by the problems which present themselves in Stearns County (Minnesota) and the panel to represent that county.

Stearns County is a medium sized county located in the central part of the State of Minnesota. It is an agricultural county with a population of 67,200. From this standpoint, it is the fourth largest county in the state. 24,000 people reside in the city of St. Cloud, which is the county seat of Stearns County. There is only one other large sized town in the county and this is Sauk Center which has a population of 3,000. The two towns mentioned are 32 miles apart, St. Cloud being in the center of the eastern border of the county while Sauk Center is at the northwest corner. The county is rectangular in shape, being 40 miles wide from east to west and 25 miles wide from north to south.

On January 1, 1941, there were 1,950 relief cases (families) in the county.

The data in the files of the Minnesota Public Health Bureau now show five recommended optometrists available for panel work in the county. Four of these practice in St. Cloud. The fifth conducts his practice in Sauk Center.

There are, however, a number of smaller towns and villages scattered about throughout the county. For instance, two towns, Belgrade with a population of 550, and Paynesville with a population of 1,300, each in the southwest corner of the county. Both of these towns and the

farmers in the rural areas which surround them are nearer to Willmar, a town in Kandiyohi County, than they are to either Sauk Center or to St. Cloud.

This is almost equally true of the people in and around the town of Kimball, which has a population of 500 and is located in the southeastern corner of the county. These folks are within the trade areas of both St. Cloud and of Buffalo, a town located in Wright County.

Now in Willmar, we have three eligible optometrists, while in Buffalo we have two.

This is also true in other directions, and so the county panel for Stearns County is made up of the recommended and eligible optometrists from Stearns County, i.e., the St. Cloud and Sauk Center optometrists, plus the practitioners from Willmar in Kandiyohi County; Buffalo in Wright County; Little Falls in Morrison County; Alexandria in Douglas County and Glenwood in Pope County. All of these towns falling within the trading territory of Stearns County.

In turn also, the St. Cloud optometrists find themselves on the County Panels for Morrison County, Benton County and Sherburne County, while the Sauk Center optometrist finds himself on the Todd County, Douglas County and Steele County panels as well as his own.

This is the manner in which panels were developed for each of the 87 counties of the state, with the exception of the counties which contain Minneapolis and St. Paul. On a following page is a duplicate, Figure 1, (reduced from 8½ in. by 11 in. in size) of one of the 87 Eye-Refraction Panel sheets used by the Association.

Obviously, each of the 87 counties requires a different panel personnel. Each county presents new problems in determining trade areas and in every case the panel personnel differs from others as the result of location. Each panel listing is the result of compiling data relative to recommended and eligible optometrists with a study of county trade areas, a job requiring the fullest knowledge of both the practitioners and the areas from which they draw their patients.

After making a study of the refractive data having to do with relief cases which had been assembled in the office of the Public Health Bureau* and coincidental with the development of county panels, the executive committee of the Minnesota State Optometric Association

*See Part I of this report.

Minnesota State Optometric Association

EYE-REFRACTION PANEL

for

Stearns County

The following optometrists are all practicing within the immediate trade area of the above county. These optometrists are all certified as to their ability as ocular refractionists by the Minnesota State Optometric Association and the Minnesota State Board of Examiners in Optometry. All practice exclusively and professionally.

These optometrists have all agreed to serve on County Refractive Panels and do ocular diagnostic and refractive work at minimum fees approved by the Department of Social Welfare of the State of Minnesota for this public health activity.

The County Refractive Panel of Optometrists for Stearns County follows:

| | |
|---|---|
| Dr. R. Klaers | St. Cloud |
| Dr. R. Colberg | St. Cloud |
| Dr. J. W. Webber | St. Cloud |
| Dr. A. G. Guy | St. Cloud |
| Dr. P. W. Hanson | Sauk Center |
| Dr. A. Hedine | Glenwood |
| Dr. I. C. Hedine | Alexandria |
| Dr. W. M. Hart | Alexandria |
| Dr. A. G. Engel | Little Falls |
| Dr. W. J. Betlock | Little Falls |
| Dr. B. E. Nelson | Buffalo |
| Dr. G. E. Ernst | Buffalo |
| Dr. W. H. Harm | Willmar |
| Dr. C. P. Rochat | Willmar |
| Dr. H. O. Sheldon | Willmar |

considered the details of a proposed refraction program to be presented to the Division of Social Welfare of the State of Minnesota.

This study revealed that the present method of handling refractions for relief cases was open to criticism on three basic counts. These

were, (1) the absence of uniform costs between counties, (2) the absence of uniformity and supervision of material which was supplied the client and (3) the lack of certification and supervision of the examiners, who were now doing the refraction work.

## THE PROPOSAL

The executive committee approved the general program of separating the refractive work and the buying of materials, and authorized the Director of the Public Health Bureau of the Minnesota State Optometric Association to submit the following proposal and a complete list of 87 county Eye-Refraction panels to the Director of the Division of Social Welfare of the State of Minnesota for his consideration and approval.

This was done, the panel lists being accompanied by the following statement:

### REFRACTIVE EYE CARE FOR THE INDIGENT AND THE MEDICALLY INDIGENT IN MINNESOTA

"A Proposal to the Division of Social Welfare, State of Minnesota, by the Minnesota State Optometric Association, Inc."

### PART 1. A STATEMENT OF THE PROBLEM

"Due to circumstances entirely beyond the control of governmental officials, social workers, professional bodies and citizens in general, certain persons have found it necessary in the past and still find it necessary at the present time, to request assistance from governmental units, to enable them to conduct the ordinary affairs of modern life. From the health standpoint, these persons fall into two groups, first the indigent, and second, those persons of very low incomes who are medically indigent. Among the requests made by members of both of these indigent groups to governmental units are the requests for refractive eye care due to uncorrected errors of refraction and/or anomalies of the extra-ocular muscles. In other words, the request is made for 'glasses' to enable the recipient of help to see properly and with comfort.

"Unlike many commodities, however, glasses cannot be supplied by the simple issuance of a purchase order. Diagnostic and refractive skills are necessary in the prescribing of these aids to vision, and the material in each case must be individually processed in accordance with a formula prescribed to correct the abnormalities found present in that particular patient. Not only must the refractive errors be properly corrected through the medium of glasses, but it is important, and considered sound practice, to make such diagnosis and prescribe such formula only after carefully discerning, by examination techniques in the hands of trained and skilled professional persons, that the patient, whose visual problems are being investigated, is free from ocular pathology which may play a part in the patient's future usefulness to society.

"For a sound program of refractive care it is therefore necessary that governmental units and agencies engage in certain practices in caring for the visual needs of indigent persons. These practices include (1) the need for proper screening to determine the economic status of the applicant, (2) the need for competent refractive care through as wide a choice of certified practitioners as possible, (3) the need for supervision in the dispensing of adequately prepared optical materials, (4) the need for uniform and standard State-wide procedures to be followed in providing refractive care, and (5) the

need of having this work done at a cost as low as possible for efficient care of all indigent cases."

## PART II. IN REVIEW

"During the past several years, indigent persons in Minnesota have been furnished refractive assistance by County Welfare Boards and by certain city Relief departments. After certification by the Board the client has been given an order for 'glasses.' These orders have been filled by optometrists and eye physicians whom the client has consulted to secure relief from his or her symptoms. As a rule the work has been done well, but inasmuch as there has been little or no uniformity of program among the several counties, we find as a result of a State-wide survey conducted by the Public Health Bureau of the Minnesota State Optometric Association that the present refractive program for the indigent can be improved by the adoption of certain suggestions which would (1) reduce the total cost of this service, and (2) should do much towards further improving the general level of refractive work done for these persons.

"As has just been said, the work has been done rather well in the past. This is largely due to the interest taken in this special activity by optometrists and eye physicians who have been consulted by these refractive cases. However, the present method of handling the refractive program for indigent persons may be criticized because, (1) of a lack of certification and supervision of the examiners who are doing the work, (2) the absence of standardization of costs between counties and (3) the absence of proper and uniform supervision of the materials which are supplied to the clients in the form of glasses.

"It is believed by the Minnesota State Optometric Association that the suggested procedure, which is hereby presented to the Division of Social Welfare of the State of Minnesota, will do much toward rectifying possible criticism of present procedures and will make the refractive program for indigent cases one which meets all previously stated and necessary requirements already set forth in the statement of the Problem, Part I of this presentation."

## PART III. THE PROPOSAL

"Any proposal dealing with a State-wide Public Health program for the indigent must be based upon several fundamentals which are inherently a part of the American way of life, and which are basic if the work is to be done with the thoroughness which typifies American enterprise. These fundamentals are (1) proper screening of applicants, (2) as free choice of doctor as is possible without impairing standards, and (3) the standardization of procedures as these have to do with patient or client control; the records which must be kept in this work, and (4) the supervision of materials which must be prescribed.

"The proposal which follows has to do with points two, three and four of the above, the Minnesota State Optometric Association believing that under the guidance of the Division of Social Welfare, the various County Boards and City Relief Departments are already equipped to do a good piece of screening of the applicants for assistance."

### A. Eye Examinations (Professional Work)

"In the past ocular examinations for indigent persons in Minnesota have been made by optometrists and eye physicians. It is proposed that this be continued and that the patient be given as wide a choice of practitioner as possible. To assist the various County Boards and City Relief Departments in their administrative work with this problem the Minnesota State Optometric Association has developed, on a State-wide county basis, an ocular program which was inaugurated several years ago in Minneapolis and which has been used successfully by the relief authorities of that city for more than two years. The first portion of the proposed program has to do with the County Panel of Optometrists and the part these panels can play in the proper development of a sound refractive program.

"On such County Panels the Minnesota State Optometric Association places the names of all optometrists who meet the following qualifications: (1) The optometrists must have civic standing in their own communities. (2) They must be devoting all of their time to the practice of ocular refraction and must be practicing professionally.

(3) In addition to adequate undergraduate college training and to their registration by examination as optometrists by the State, they must have proved to their associates that they are qualified to diagnose ocular pathology as well as proved their capabilities as ocular refractionists. And (4) they must carry professional mal-practice insurance to cover both the County or City Board for whom he works as well as himself. All optometrists who meet these stringent qualifications and who wish to do this County or City work at a stated minimum fee have had their names placed upon County Panels. There have been no other requirements on their part. These County Panels conform to the type and character of the original panel as developed in Minneapolis several years ago. (A similar panel of eye physicians has also been set up in Minneapolis and patients are given their choice of refractionists from the joint lists.)

"The new development of similar panels for each county in the state assures the various County Welfare Boards of competent refractive care through as wide a choice of certified practitioners as possible, and as the men are serving on individual County Panels it enables the county authorities to easily exercise the regulations of their local programs. Obviously, each County Welfare Board is free to add the names of other practitioners to their panel, but the Minnesota State Optometric Association can be responsible for the conduct of only those men placed on the panel by the society.

"The panel of optometrists has worked well in Minneapolis and we suggest the use of a similar panel organization for each of the counties of the state. To the County Panel of Optometrists it is suggested that each local Welfare Board add the names of local eye physicians (when and where these men are available) thus affording each county a list of capable and available refractionists in the immediate trade-area of their particular county."

B. Glasses (Materials)

"To afford uniformity throughout the various counties and to keep the costs of the suggested program at a low figure it is proposed that the material used be standardized as to both type and quality, and that this material be supplied for each County Board only on order of the County Board, countersigned by either the optometrist or eye physician who makes the examination.

"The procedure would be as follows: The examiner after making the ocular examination would write the prescription formula on a special County Refraction Order. The examiner would also fill out this form giving the necessary frame and facial measurements, supplying such data as to enable an optician to properly make a pair of glasses from this order form.

"The examiner would then mail the order for glasses to specified and supervised central sources of supply, who would make the glasses and return them to the examiner. The indigent patient or client would also return to the examiner and have the glasses dispensed and adjusted by him.

"Detailed specifications as to lens quality and frame material will be furnished on request of the Department of Social Welfare by the Minnesota State Optometric Association, as well as a list of manufacturing opticians, who are willing to engage in this work for County Boards at a low fee basis.

"If deemed advisable, the Minnesota State Optometric Association will assist the Department of Social Welfare in making the arrangements with, and in the supervisory activities of the work of manufacturing opticians who will fill the refractive prescriptions, and the association offers its assistance in arranging the details necessary for the proper manufacturing of glasses to be supplied under this program."

C. Fees

1. *Professional*

"In the past and at present various County Boards have permitted varying fees for ocular work. The minimum fee for complete refractive service was found to be $7.50 which included an eye examination, single vision lenses, frame and case. There has been no general supervision of quality of materials used, as the optometrist or eye physician has been expected to buy the material himself and supply same to the patient.

"In the past and at present the minimum county fee for bifocal corrections is

$10.00. In many counties the fees allowed were, and still are, considerably higher, although there is some question that the quality of materials used improves proportionately as the county increases the total of the allowed fee for each case.

"The Minnesota State Optometric Association proposes that a uniform fee of $3.00 be paid by the County Board direct to the optometrist or eye physician for each ocular examination made by him on county order for indigent persons."

2. *Materials*

"The Minnesota State Optometric Association also proposes to arrange with central sources of optical materials to supply to County Boards first quality glasses at approximately the following schedule of charges:

"Single vision lenses, first quality, in a 1/10-12K gold-filled frame, with case at an average cost of $4.00.

"Bifocal lenses in similar frame with case at an average cost of $6.00.

"There would be a slight variance in the minimum cost dependent upon lens strength. The proposal includes a first quality engraved gold-filled frame, leaf shaped lenses, pad bridge and engraved temples. In other words, a first quality product throughout at a fee within the individual counties' ability to pay."

PART IV. IN CONCLUSION

"The proposal as herein outlined by the Minnesota State Association of Optometrists meets the necessary qualifications already set forth. Competent refractive care is provided through a certified panel of optometrists. The patient is given a wide choice of practitioners. Supervision is provided for the materials to be dispensed under a statewide uniform plan, and the total cost is kept at a satisfactory low figure.

"The combined professional fee plus the cost of material will total less than the county allowance now in effect in any of the counties and much lower than most. Patients will be given an excellent refractive service in the office of the doctor where he is best able to serve, and the materials which will be dispensed will meet all tests for serviceable, practical and well appearing glasses.

"On the following pages will be found the names of individual optometrists who fully meet the qualifications already mentioned, and who have agreed to serve on their respective panels. A refractive panel has been set up for each of the 87 counties of the state. The panels are arranged alphabetically by counties."

Following the submission of the plan for refractive eye care to the Director of the Division of Social Welfare, and because of his evident interest in the plan and desire to improve the general level of refractive assistance given indigent persons in the state, the Public Health Bureau of the Minnesota State Optometric Association next turned to the second phase of this activity. This being to put into practical working form a properly suggested dispensing program for indigent persons to supplement the already developed and suggested program of eye examination service.

*A Program of Dispensing Optical Materials.*

A dispensing program which will satisfy all requirements must have sources of supply which (1) are fully equipped mechanically to do all forms of optical work, (2) have on hand adequate stocks of

materials from which to service county panels, (3) are centrally located for rapid mail service to all parts of the state, (4) are willing to do this special optical work on a low fee basis, and (5) are willing to coordinate their activities in this field under the general supervision of the Minnesota State Division of Social Welfare.

A solution to this dispensing program can be arrived at through two distinct approaches. The first approach requires a mutual understanding of the problem and a general willingness of all or most manufacturing opticians in the state to cooperate with the Minnesota State Division of Social Welfare in jointly supplying materials for indigent persons to the County Welfare Boards on a low fee basis. The second approach being to contract for all material with a single source of supply on a uniform annual low-bid basis. The winning low bidder putting up a performance bond to assure satisfactory fulfillment of his contract.

Both plans were studied by the Public Health Bureau. It was obvious that a single low-bid contract would probably buy optical materials at a figure slightly lower than one agreed to by all manufacturers. Also a single source of supply would make easier the work of supervising the materials which were to be used, and from a county standpoint, a single source of supply would simplify billing and checking of accounts.

On the other hand, a single source of supply for the entire state would deny the optometrist or eye physician a free choice of material supply. Experience has also shown that in awarding contracts of this kind, that very small and at times quite inadequately equipped manufacturers secure these contracts by underestimating their actual overhead costs and in that event the quality of the work is made to suffer to offset the lowness of the bid. A single source of supply secured on a low-bid basis assures nothing in the way of a central source of supply as the winning bidder may be located at some distance from the majority of counties he is to serve. The single source of supply also has the disadvantage which accompanies the lack of competition during the actual term of the contract, this fact tending to bring the quality of work down to that point just passing minimum standards.

It was therefore decided that the Public Health Bureau would make every effort to bring into this suggested program every manufacturing optician in the state. To get these manufacturers to agree mutually to

supply certain basically uniform and specified quality materials on county order for indigent persons. This to be done at a low fee basis.

Contacts were then made with the manufacturing opticians of Minnesota. These included the local branches of national manufacturers, all independent manufacturing opticians and all large retail dispensing opticians who operated completely equipped laboratories.

Through the efforts of the local leaders in the industry all manufacturing opticians were enrolled, and laboratory fees were tentatively agreed upon.

Twenty-eight laboratories were invited and enrolled in the suggested or proposed plan. Nine of these were in Minneapolis; five in St. Paul; two each in Duluth, Fargo and Grand Forks, with one firm each in the following Minnesota and adjoining cities: Albert Lea, Crookston, Fergus Falls, La Crosse, Mankato, St. Cloud, Sioux Falls and Winona. This willingness on the part of manufacturing opticians to cooperate in this program, made possible excellent state-wide coverage of manufacturing or laboratory facilities and affords the optometrist or eye physician a wide choice of opticians to whom his county refraction order for glasses could be sent.

The writer observed that these opticians were appreciative of the opportunity offered to serve local County Welfare Boards at prices which permitted the use of quality materials and on the basis of free choice of material-supply.

They agreed to manufacture glasses for authorized county relief clients and send the finished product back for dispensing to the optometrist or eye physician who had ordered the materials. At the same time sending the bill for the materials to the county welfare board where the eye refraction order originated after first having the bill approved by the optometrist or eye physician who made the refraction.

The Public Health Bureau and the Executive Committee of the Minnesota State Optometric Association were pleased that every available optician, in the state as well as in the immediate trade area of the state, agreed to cooperate in this proposed and important social program of refractive eye care.

These proposals, having to do with the manufacture and costs of optical materials, were then submitted to Mr. Walter W. Finke, Director of the Division of Social Welfare of the State of Minnesota.

This was done in the Fall of 1941. The proposals were accompanied by a list of manufacturing opticians who had agreed to furnish the materials mentioned in the proposal.

As this was done during the late pre-war period, and as Mr. Finke was then (and still is) very busy with the work of his department as well as special war-time assignments, the disposition of the matter of a program for the handling of optical materials was temporarily delayed.

## APPENDIX

### THE ADOPTION OF A STATE WIDE PROGRAM OF REFRACTIVE EYE CARE*

*The Matter of Suggested Refraction Fees for Optometrists and Eye Physicians is Concluded.*

The amount of the fee to be paid the optometrist and eye physician in examining the eyes and prescribing for the visual defects of indigent persons was concluded through the actions taken, as outlined, in the following correspondence:

STATE OF MINNESOTA
DIVISION OF SOCIAL WELFARE

WALTER W. FINKE, *Director* Saint Paul, December 26, 1941.

Dr. Carel C. Koch, Director
Public Health Bureau
Minnesota State Optometric Assn., Inc.
1501 Foshay Tower
Minneapolis, Minnesota

My dear Dr. Koch:

I wish to inform you that this week we are sending out a uniform state-wide suggested allowance for medical services for recipients of relief and public assistance. I indicated in our previous correspondence that as soon as we had finished this job I would write to you regarding a fee schedule for refractions done by optometrists.

After careful study of the problem in cooperation with the Medical Unit of my Division, I would suggest that we establish a fee of $3 for refractions done by optometrists, which is the amount which you have suggested to me. This is the same fee that will be paid to doctors in medicine, who will do refractions throughout rural areas in the state. This will not include glasses.

I believe that the matter of developing a standard fee for glasses and frames is one which should be taken up by the Chief of our Medical Unit with optical firms throughout the state so that we may have standard specifications and a uniform fee schedule for relief and public assistance clients. I am asking the Chief of our Medical Unit to look into this problem immediately.

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*The following material has been added to this report since its presentation on December 7, 1941. This appendix serves only to indicate to the reader, the final disposition of this matter.

In regard to order blanks for refraction services*, I do not believe it would be wise for this Division to suggest a special form for any group of practitioners. However, it may be wise to make a survey of the procedures used in the counties, and on the basis of such a survey, to develop a suggsted form for use by all practitioners throughout the state.

If the fee schedule suggested for refractions performed by optometrists appears to be reasonable to the Minnesota State Optometric Association, I shall be glad to send out a bulletin to the counties to this effect.

WALTER W. FINKE, *Director.*

To which, the following reply was sent:

Mr. Walter W. Finke, Director
State of Minnesota
Division of Social Welfare
St. Paul, Minn.

December 31, 1941.

Dear Mr. Finke:

In reply to your letter of December 26th, I wish to state that the three dollar ($3.00) refraction fee mentioned has the approval of the Minnesota State Optometric Association, Inc., and that we would appreciate your sending out the bulletin mentioned.

I might add also, that the entire proposal having to do with both refractions as well as materials has been approved by the Association and we shall be happy to work out the present details as well as future ones with you and your Medical Unit.

Carel C. Koch, Director,
Public Health Bureau

The Minnesota State Optometric Association was officially informed of the action taken relative to refraction fees for indigent persons by the Division of Social Welfare in a letter written by the Director of the Department, Mr. Walter W. Finke, (February 13, 1942) which says in part:

"This is to advise you that the fee of three dollars ($3.00), as previously suggested, has now actually been established as the suggested refraction fee for optometrists and practitioners of medicine doing refractions throughout rural areas of the state.

"You understand, of course, that this fee is established on the basis as all other items on the uniform medical fee schedule which has been released through this office. This schedule is not mandatory on local welfare boards but is a suggested guide for their use in connection with relief and assistance cases."

The foregoing official action of the Division of Social Welfare of the State of Minnesota, in including in its schedule of suggested uniform medical fees, the suggested fee of three dollars ($3) to be paid optometrists and eye physicians by Welfare Boards for refractions made upon indigent persons, concluded the arrangements with the Division of Social Welfare relative to professional fees for refractive work.

Before leaving the question of fees, however, it is well to note that a suggested fee for an ophthalmological examination has also been

*Suggested to the Division of Social Welfare by the Minnesota State Optometric Association in previous correspondence.

included in the uniform schedule. This fee applies to only a limited number of qualified ophthalmologists who serve under the Technical Advisory Committee on Ophthalmology of the Division of Social Welfare, and whose duty it is to examine, treat, rehabilitate and to certify clients for the State Department of the Blind. This special ophthalmological examination fee for pathological eye cases is five dollars ($5). This fee is not to be confused with the refraction fee of three dollars ($3) suggested for all optometrists and eye physicians in general.

*The matter of furnishing Optical Materials to Clients of Welfare Boards is Concluded.*

The matter of optical materials was re-opened upon the receipt of the following letter:

STATE OF MINNESOTA
DIVISION OF SOCIAL WELFARE

WALTER W. FINKE, *Director* St. Paul, March 3, 1942.

Dr. Carel C. Koch, Director
Public Health Bureau
1501 Foshay Tower
Minneapolis, Minnesota

My dear Doctor Koch:

For some time, efforts have been made to determine a uniform state-wide fee schedule for frames and lenses for glasses provided recipients of public assistance. This particular matter, and others, involve jointly the field of optometry and that of ophthalmology.

As a result, it has been deemed advisable to secure the consultation of representatives of both of these professional fields. To do so, a committee is being organized, consisting of three ophthalmologists and three optometrists. Dr. A. W. Adson, Chairman of the State Medical Advisory Committee to this Division will be asked to preside as Chairman of this joint committee.

So far as is now known, the committee will meet at 2:00 p.m. on Tuesday, March 24th at 610 Globe Building, St. Paul.

Your name has been suggested as one of those to represent the optometrists, and I would appreciate your serving in this capacity. Will you kindly let me hear from you in this regard at your earliest convenience?

WALTER W. FINKE, *Director.*

The Technical Advisory Committee on Ocular Refraction of the Division of Social Welfare held its first meeting on March 24, 1942. Dr. A. W. Adson, Chairman of the State Medical Advisory Committee for the Division of Social Welfare was in the Chair. The ophthalmologists were represented by Dr. A. D. Prangen, Dr. C. E. Stanford and Dr. W. T. Wenner; the optometrists by Dr. R. H. Ehrenberg, Dr. C. L. Peterson and Dr. Carel C. Koch. Dr. Edward Simon, Chief

of the Medical Unit of the Division of Social Welfare was also present.

Dr. Adson spoke of the broad implications of a health program as these affected all professions. He felt that these could best be worked out to the mutual advantage of the public and the professions by helpful and mutual cooperation. Dr. Simon reviewed the dispensing problem which was now before the committee and outlined several tentative solutions including the one presented by the Minnesota State Optometric Asociation.

It was the concensus of the committee that the optometrist or eye physician should have a free choice of material supply if this is possible, and that in a great part, the dispensing proposals having to do with optical materials as suggested by the Minnesota State Optometric Association be approved although it was felt that every effort should be made to keep the costs of both lenses and frames at the lowest possible level.

With this in mind, the committee approved and recommended to the Division of Social Welfare (1) that the dispensing program as outlined be adopted by the department. (2) That a sub-committee of the Technical Advisory Committee on Ocular Refraction be created by the chairman to meet with representatives of the optical industry to revise as far as possible the proposed schedule of charges for materials, and (3) that upon completion of the new schedule of material charges, that the Division of Social Welfare so notify all county Welfare Boards.

The chairman, Dr. Adson, appointed Dr. Carel C. Koch and Dr. C. E. Sanford to serve as the sub-committee, and requested that they make the necessary contacts at once. The committee adjourned, feeling that much had been accomplished for the general good of the citizens of the state, and that they would reconvene when other problems in the refractive field presented themselves.

The sub-committee met on April 1, 1942, with several local manufacturing opticians. Dr. Edward Simon was also present. A revised schedule of charges for single vision lenses and bifocal lenses as well as a price for a designated frame was agreed upon. The Division of Social Welfare requested the Minnesota State Optometric Association to notify all of the previously contacted manufacturing opticians of the revised schedule of charges for material to apply on County Orders for certified indigent cases referred to optometrists or eye physicians for refractive work by County Welfare Boards.

At the same time, Dr. Edward Simon of the Division of Social

Welfare agreed to notify all County Welfare Boards of the suggested procedure of securing optical materials for indigent persons, and the suggested charges for these materials, also requesting the fullest cooperation on the part of the boards, thus putting the suggested dispensing program into effect.

The bulletin of the Division of Social Welfare and the revised schedule of charges for optical material follows:

STATE OF MINNESOTA
DIVISION OF SOCIAL WELFARE

WALTER W. FINKE, *Director* St. Paul, May 12, 1942.

TO: Chairman, County Welfare Board
Attention: Executive Secretary

SUBJECT: Optical Code and Price Schedule

The optical code and price schedule here recommended for adoption by county welfare boards was developed by a committee of three ophthalmologists and three optometrists, presided over by the Chairman of the State Medical Advisory Committee, Dr. A. W. Adson, serving at the request of Mr. Finke, the Director of the Division of Social Welfare. With this schedule, it will be possible to provide recipients with needed glasses at the lowest cost consistent with quality.

The schedule agreed upon provides a fee of $3.00 to a physician or optometrist for refraction. In the event special eye examination including refraction is required, an authorization for an ophthalmologist's examination may provide for a fee of $5.00. The cost of frames and lenses is to be found in the schedule below and depends to a large extent on the prescription.

The recipient who is to receive eye examination and glasses on relief order may be provided with an authorization for examination and glasses. When the examination is completed and if glasses are necessary, the examiner is to return the authorization to the welfare office for the making out of relief order covering the examination and the cost of glasses, this cost being indicated by the examiner on the authorization sheet. The relief order is to be sent to the examiner who then sends the prescription to the optical firm. (The amount of the order may include examination, glasses, glass case and postage.)

The optical firm is to mail the glasses to the examiner, thus giving him an opportunity to inspect the glasses and to check the optical firm's bill against the price schedule. When the glasses are delivered to the recipient, the relief order is to be signed as a receipt of the goods and services. Accompanied by a verified claim, the relief order may then be forwarded to the welfare office for proper payment of the total sum to the examiner.

Free choice of physician, optometrist, or ophthalmologist must be given the recipient. It is urgently recommended that relief recipients not be allowed to supplement the prices below in order to obtain other shapes, types, or quality of lenses and frames.

Specifications include Pink G.F.M. frames. The price of the frame agreed upon was $1.75. Cases can be supplied at an additional cost of 15 cents, and the expenditure is considered justified to minimize breakage. Mailing costs average 12 cents and should be allowed.

Recipients of old age assistance, aid to dependent children, aid to the needy blind, and disabled war veterans relief may enjoy the advantage of the above price schedule. If such recipients buy glasses out of their grant and by cash, they must have their recipient status verified, which may be done by a statement as to status on the stationery of the welfare board or by such other means as may be worked out between the welfare office and the examiner.

These prices have been agreed upon by representatives of optical firms and examiners as a means of making better sight more easily and more generally available to recipients of public aid. The price schedule is therefore a substantial contribution to the welfare of the recipients and is in fact a highly meritorious cooperation in the cause of better welfare care. Because of this, it should be clearly understood that the prices listed are not available to the general public nor to any other purchaser who is not receiving public aid.

Sincerely yours,

F. R. CHAILQUIST,
Acting Director.

Issued for:

Medical Unit,
E. J. Simons, M.D., Chief.

(The bulletin next included a complete schedule of laboratory fees for the various divisions of spheres, cylinders and sphero-cylinders in both single vision and bifocal (Kryptok) lenses. The suggested price schedule comparing in most cases to the Nomarex price list now in force throughout this trade territory.)

*Conclusion*

A plan for refractive eye care by optometrists and eye physicians for the indigent of Minnesota was presented to, and accepted by, the Division of Social Welfare of the State of Minnesota. Under the direction of Mr. Walter W. Finke, Mr. F. R. Chailquist and Dr. Edward Simon, staff workers of this department have placed the details of this refraction and dispensing program before the 87 County Welfare Boards and asked their cooperation.

While the program has not been in state-wide effect for a long period, it has already demonstrated its economy, usefulness and efficiency. Clients of County Welfare Boards are assured of competent eye refractions and quality materials used in the correction of their visual defects. County Welfare Boards are assured of having this work done properly and at minimum levels of professional fees and material charges.

The adopted program coordinates the joint refractive abilities of both optometrists and eye physicians, a move which should tend towards better professional relations, and the refractive machinery is now in operation to serve the State of Minnesota in whatever social reforms the future will bring to the health field.

The panel system assists the Minnesota State Optometric Association in its demands upon all optometrists for a high standard of professional work in actual practice and will enable this organization to make further technical advances in the refractive and diagnostic skills throughout the optometric body of the state.

Through the Zone organizations and County Panels of Optom-

etrists, additional refractive-sociological problems can be properly approached and studied, and progress made toward the goal of giving all citizens adequate refractive eye care.

Through the Technical Advisory Committee on Ocular Refraction of the Division of Social Welfare broad policies as well as administrative procedures can be worked out to properly regulate and safeguard both the programs themselves and the professions which will carry them out.

Through the Division of Social Welfare itself will come the inspiration and leadership so necessary to the public in a period of war and the period of social readjustment which will follow the war.

The writer wishes to express to Mr. Walter W. Finke, Mr. F. R. Chailquist, Dr. Edward Simon and Dr. A. W. Adson his sincere thanks and appreciation for their generous consideration of these refractive problems, and their helpful advice and cooperation.

## DISCUSSION

DR. ERNEST PETRY, ROCHESTER, NEW YORK: We must all admit that the economic trends of our country, which have been influenced by a new order of international responsibility, point toward a permanent need, on the part of the national, state, and local governments, to establish services of various kinds to maintain a desirable organic efficiency of its population.

The thoroughness with which this Minnesota project has been planned is to be commended and Doctor Koch has left no room for discussion of detail.

There are several thoughts that come to mind as we study the problem and one of these has to do with the magnitude of the job and the available manpower necessary. If Stearns County, Minnesota, represents an average condition of the state with a population of 67,200 and a relief list of 1,950 families and assuming that there are four people in each family we find a total of 7,800 people becoming eligible for a free refraction service.

Statistics indicate that only 20% of the population wear glasses, although 60% need them, and we can assume that practically all of these are in the non-indigent group. This would account for 11,880 individuals who now wear glasses. Adding to this the 60% of the indigent group, or 4,680, who need refractive care, and who under this plan

may in time get it, the total existing demand will be 16,560 or a 39.3% increase.

The question is, can the panel of Stearns County absorb this increase? It must be borne in mind that this increase will not be equally distributed.

It must be further borne in mind that this greater volume of service induced by this health program will cause an increase in the demand on the part of the non-indigent group.

All of this points to the fact that something should be done to provide for an increase in the personnel responsible for rendering optometric service because it does not seem reasonable that even a 40% increase can be absorbed.

Furthermore, since the figures quoted are based on present day conditions, when the economic structure is at a relatively high level, a depression period will more than double the service demand for indigents and thus swamp the optometrists, eye physicians and ophthalmologists. This is a problem which will require much future study.

# ON PRIMARY GLAUCOMA*

Charles I. Saks, D.O.S.
Syracuse, N. Y.

The additional clinical data and related phenomena presented herein, appear to show that primary glaucoma is not due to drainage interference.

Additional clinical evidence is presented to show that myopia and hypertension appear to have no relationship whatever.

In this presentation, an attempt is made to reveal the probable cause of primary glaucoma.

In previous papers, considerable clinical and experimental data were submitted relating to the complex mechanism involving primary glaucoma.[1,2]

Evidence points to the fact that darkness is a primary *contributing* factor in its causation, and the prevention of exposure to darkness appears to be a necessary step in the prevention and definite control of this disease.

Even though glaucoma is more common in hot countries than in cold, it is generally found that it occurs more frequently during the winter months, especially in the acute cases. During winter, the nights are longer, and the average person is apt to go to bed much earlier than in the summer months. Hence they are exposed to darkness for longer periods. In India, it is most frequent in June and July when solar radiation is at a *minimum*.[3] These points appear to stress the belief that darkness is a highly important factor in the etiology of primary glaucoma.

Blood pressure does not appear to have any effect on intraocular pressure. This was brought out in a previous paper.[1] It has been shown that in poisoning by quinine or the barbiturates, the ocular tension *falls* in spite of a *rise* in blood pressure.[4] In diabetic coma where the loss of tension may be very profound, the intraocular pressure is inde-

*Submitted on May 30, 1942, for publication in the September, 1942, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

pendent of the height of the blood pressure. According to Sallmann and Kahler, in cases of cerebral diplegia, the intraocular pressure is lower on the paralyzed side even though the blood pressure is higher.[5]

The writer has advanced arguments in previous papers[1,2] tending to support the contention that primary glaucoma is not due to drainage interference. There is further clinical evidence that lends strong support to this point.

It has been shown that peripheral synechiae usually occur at a late stage of the disease,[6] and that they are more commonly partial, or are *absent* altogether. This absence has been verified by Priestly Smith (1879) and has been observed on clinical cases.[6] Salzmann (1914-15), who made the first observations gonioscopically, found the angle free in four cases of secondary traumatic glaucoma, and partially closed in three cases of congestive and one case of simple glaucoma. Troncoso (1925-1935) reported on a series of 87 cases. Among 26 eyes with acute congestive glaucoma, the angle was open in 26%, closed in 26%, and partially closed in 46%; among 8 eyes with chronic congestive glaucoma, the angle was open in 25%, closed in 50%, and partially closed in 25%. In 34 cases of chronic simple glaucoma, the angle was open in 58.8%, closed in 5.8% and partially closed in 38.2%. In six eyes with simple glaucoma, the angle was partly closed in 50%, and completely closed in 50%. In cases of secondary glaucoma, the angle was open in 62%, closed in 23% and partially closed in 15%. Werner (1932) observed 39 out of 49 eyes with simple glaucoma having an open angle. Barkan, Boyle and Maisler (1936) found sclerosis of the trabeculae and blockage with pigment common, and concluded that while narrowing of the angle may be an early phenomenon, its blockage by adhesions occurs only at a *late* stage.[6].

Duke-Elder[8] states therefore that an angle closed by peripheral synechiae is common *after* an attack of congestive glaucoma, *but that in chronic glaucoma the angle is usually open in the early stages and frequently remains so for a considerable time thereafter.*

A frequent occurrence in glaucomatous eyes is a deposit of pigment in the meshes of the pectinate ligament. (Levinsohn, 1908-22; Koeppe, 1916-20; Schieck, 1918; Gradle, 1921; Barkan, Boyle and Maisler, 1936). *However, pigment deposits of this nature are a constant occurrence in senile eyes,* and are found in copious formation in cases of diabetes, pigmentary degeneration of the retina and retinal detachments, *without affecting the tension.* (Trantas, 1935).[9] Accord-

ing to Duke-Elder,[9] *the deposition of pigment is a concurrent manifestation of glaucoma rather than its cause.* In a previous paper,[2] it was shown that ocular hypertension is surprisingly frequent in cases of pigmentary degeneration of the retina. The probable cause advanced by the writer is proliferation of neuroglia within the eyeball. This is substantiated by sufficient clinical evidence.[2] Furthermore, it was shown that drainage interference is a *late manifestation* of glaucoma and therefore cannot be regarded as a cause.

To show further that deposition of pigment does not appear to affect intraocular tension, it is interesting to note that in *hypotony, there is a heaping of pigmentary epithelium on the inner surface of the choroid* (Collins, 1917).[10]

In two previous papers,[1,2] it was shown that in primary glaucoma the tension is highest during the night and the very early morning hours, and lowest in the late afternoon. It is interesting to note that Hagen (1925), Raeder (1925), and Dominguez (1929) have found the *opposite* to occur in occasional cases.[11] Duke-Elder[13] also found this to occur in cases of retinal detachment, that is the tension being *lowest in the early morning hours,* and *highest in the late afternoon!* This evidence appears to support the writer's theory on the etiology of primary glaucoma.

It was brought out previously[1,2] that light causes constriction, and darkness dilation of the intraocular vessels, particularly those of the choroid. An attempt will be made to show through what medium light and dark appear to affect the respective constriction and dilation of the choroidal vessels.

From the evidence at hand, it seems that the pressure controlling mechanism of the eyeball appears to originate in the chemical anomalies of the regenerated visual purple in darkness, and will occur only if contact with the retinal epithelium be maintained.[21]

Oguchi's disease,[22] a congenital and stationary form of night blindness first described by Oguchi (1907) in Japan from which country most cases have been reported, appears to lend some evidence that the bleaching and regeneration of the visual purple causes the respective constriction and dilation of the choroidal vessels. Ordinarily in this disease, the posterior region, and sometimes the entire fundus is of a grey color which is probably due to a layer of abnormal tissue between the cones and pigment epithelium. After some hours in the dark, the grey

color is replaced by the normal red appearance. In dim illumination, night blindness exists until several hours have been spent in the dark, when vision slowly improves. It is to be noted that after some hours in the dark, the fundus assumes a normal red color simultaneously with the improvement of dark adaptation. It seems likely that the *regeneration* of the visual purple is closely related to the *dilation* of the choroidal vessels which is made evident by the fact that the fundus assumes a normal red color after remaining in the dark a few hours. This appears to demonstrate further that darkness causes dilation of the intraocular vessels resulting in increased vascularization of the inner eyeball.

According to Hecht (1919-25)[23] the visual purple is a photochemical substance split up under the influence of light into two components, and that when the light is removed, these two components combine again to form the original substance.

Since poor dark adaptation is found in eyes having either high or normal tension (such as in cases of the early stage of retinal pigmentary degeneration), it seems that these two components forming the visual purple do not combine completely in darkness, with the result that some of each component is free to act individually, one affecting dark adaptation and the other causing dilation of the intraocular vessels, both substances being effective only in the absence of light, since we know that the intraocular vessels dilate only in darkness. This fact was demonstrated in Oguchi's disease. When the eye is exposed to light, one of these two components probably acts as the interposing medium in bringing about constriction of the intraocular vessels. An attempt will be made therefore to show that the chemical behavior of the visual purple appears to be the interposing medium between the dark-light stimulus and the response of the intraocular "vessel" musculature.

The further possibility of an interposing mechanism as a controlling factor in the action of the intraocular vessels is the *opposite* effect of light on the surface vessels of the skin. According to Laurens,[24] light, within physiological limits, may cause the cutaneous vessels to *dilate* and thereby allow more blood to go to the skin. During long continued exclusion of light, the skin vessels become constricted and the skin thus assumes a bloodless appearance. Furthermore Balderry and Barkus (1924) demonstrated that the primary effect of irradiation is vasodilation.[25] It is interesting to note further that in long continued exclusion of light during polar expeditions, the skin becomes quite pale, assuming a yellow-green color.[24] According to Laurens[24] the pallor of

persons working and living in poorly lighted rooms does not necessarily mean they are anemic, but that the volume of blood going to the skin and underlying muscles is diminished. This has been demonstrated in an exhaustive study.[24]

The point to be emphasized here is the contrasting effect the light-dark stimulus has on the intraocular and cutaneous vessels. To recapitulate, light causes *constriction* of the intraocular vessels, and *dilation* of the cutaneous vessels; whereas darkness causes *dilation* of the intraocular vessels and *constriction* of the cutaneous vessels.

Now then, the fact that in cases of detached retina the diurnal pressure changes are *opposite* to those cases where no retinal detachment exists, seems to show that an interposing mechanism exists in the eye, and that this interposing mechanism appears to be the visual purple, because it is not formed when there is a detachment of the retina, that is, if there is no contact with the retinal epithelium. (It is advisable at this time to point out that what appears clinically to be a retinal detachment is, in the large majority of cases, not a true detachment, but a separation of the nervous portion from the pigmentary layer. According to Wolff, the only true detachment is in cases of saroma of the choroid.)[26] Therefore, in cases of detached retina, the effect of the light-dark stimulus on the intraocular and cutaneous vessels is *exactly the same.*

From this it appears therefore that the cases presented by Hagen, Raeder and Dominguez were those of detached retinas.[11]

It seems likely that the *total* effect of light and dark on the intraocular pressure in cases of detached retina may depend on the area and location of detachment, for light will cause *dilation* of those vessels in the region of detachment, and *constriction* in the region where no detachment exists. However, from the physiological standpoint, we cannot consider sharp lines of demarcation because it is possible that the area of detachment may vary because of movements of the eyeball. Even if the area of detachment should be constant, the physiological and physical areas of constriction or dilation would not necessarily coincide because nervous reflexes are well apt to extend beyond the border of detachment.

It is interesting to note that Hagen (1925), Raeder (1925), Feigenbaum (1928), and Magitot (1933) found that in secondary glaucoma, exposure to darkness may cause no variation in pressure, or

the pressure may fall.[14] In those cases where darkness causes no variation in pressure, it may be possible that a destructive lesion has taken its toll, that is, disrupted the visual purple forming mechanism, or the tone of the choroidal vessels is non-existent due to arteriosclerotic or other pathological changes. In those cases where darkness causes a *fall* in pressure, the result may be due to retinal detachment or disruption of the visual purple forming mechanism *without involvement of the choroidal vessel walls.* In the latter case, darkness would *not* cause a fall in pressure if the tone of the choroidal vessels, for any reason, was non-existent. It may be added that should light and dark cause pressure changes in secondary glaucoma similar to those found in primary glaucoma, then there may be a strong possibility that a *combined* glaucoma exists, that is, the possibility of a combined primary and secondary glaucoma.

If it is true that constriction and dilation of the choroidal vessels are controlled by the photochemical changes of the visual purple, then it appears that the physiology (or pathology) of the liver may have some relationship with the intraocular pressure. In the frog, pigment migration is stopped by the subcutaneous injection of bile salts (Yamada, 1919), or the isolation of the liver from the general circulation (Kumagai, 1915).[27]

Pathological changes in the liver have been associated with the etiology of night blindness. Injections of bile and its derivatives have a similar result in experimental animals.[28] In diseases of the liver, according to Percy W. Cobb, night blindness is closely associated with jaundice.[29] According to Adler, there is clinical evidence that some substance present in the liver is concerned with rod visual purple function.[30]

Because of the above facts, there may be some possibility that some excretory substance of the liver liberated into the blood stream may exert some influence on the behavior of the visual purple.

The writer makes no attempt to show that night blindness bears any relationship whatever to intraocular pressure or increased vascularization of the inner eyeball. Night blindness, or involvement of the dark adaptation mechanism, so far as the writer can see, appears to be merely a consequence in the anomalous chemical behavior of the visual purple.

It seems reasonable to believe that the aberrant behavior of the visual purple or its substance forming mechanism (the rods) may be regarded as an etiological factor of ocular hypertension in darkness. The visual purple is an *interposing mechanism* because of the following facts:

1. In retinal detachment, the light-dark stimulus effects the intraocular vessels opposite to those cases where there is no retinal detachment, and the diurnal pressure changes have been found to be the reverse of that found where no known retinal detachment exists.

2. In retinal detachment, we know that there is no formation of visual purple in darkness.

3. In the normal young eye, the walls of the blood vessels are much more yielding than in older eyes. (Kerschbaumer[34] has shown that there is clouding and thickening of the vessel walls of the choroid in the fortieth year and beyond.) Yet exposure to darkness causes a negligible increase in intraocular pressure in young eyes, being apparently absent, or varying between two or three mm.Hg.[35] This negligible increase may be due to reflex constriction of the circular muscle fibres of the vessel walls. In other words the excess dilation of the intraocular vessels in darkness may be kept in check by the antagonistic action of the circular muscle fibres of the vessel walls. However, it seems more likely that hypertension in young eyes is not caused by darkness because there is probably a normal physiological functioning of the visual purple and the mechanism forming it, that is, when light causes the visual purple to split up into two substances, as brought out by Hecht,[23] these two substances probably combine *completely* to form the original substance when exposed to darkness. This reason seems to be borne out in cases of buphthalmos (infantile glaucoma).[31-33] In this condition the marked yielding of the intraocular vessels brought about by the powerful dilatory action of their musculature, which in turn may be brought about by the anomalous behavior of the visual purple in darkness, may account for the extreme increase of intraocular pressure, 40 to 90 mm.Hg.

The "visual purple theory" may be questioned because the intraocular tension in the majority of cases of detached retina, while remaining normal at first or occasionally being raised, *tends to fall to a subnormal level as the age of detachment increases.* (Nordenson, 1887; Leber, 1916; Kleiner, 1933.)[19] The subnormal tension in detachment of the retina, according to the writer, may be explained by the fact that the choroidal vascularization is diminished because of cessation of retinal activity in the area of detachment, that is, the retina cannot function as a sight perceiving layer when the nervous portion is separated from the pigmentary layer. This means there is well apt to be a diminished quantity of blood within the eyeball. Apart from this, the important point

to bear in mind is that the diurnal pressure changes in cases of detached retina are *opposite* to those cases where no retinal detachment exists.

Seidel (1920)[14] observed a rise of from 20 to 80 mm.Hg. after a half hour exposure in the dark, and a return to normal within a half hour in the light, and Poos (1934) found a rise of over 15 mm. in 70% of his cases of primary glaucoma, which was usually lowered by the previous instillation of eserine. However, Poos does not state the percentage or the amount of drop in tension caused by the previous instillation of eserine. It was brought out in a previous paper[1,2] that cases have been recorded where an acute rise of tension followed the instillation of pilocarpine. It was also brought out in a previous paper[1] that dark adaptation causes dilation of the intraocular vessels resulting in increased tension in blind and seeing eyes, occurring indifferently in aniridia, after an iridectomy and with pilocarpine or atropine. (Feigenbaum, 1928-29.)[32]

The depth of the anterior chamber does not appear to exert any predisposing influence in the occurrence of glaucoma. In the young, the anterior chamber is deep, and in the old-shallow.[15] This may be due to the growth of the lens which is 1/3 larger at the age of 65 according to Priestly Smith.[16] In emmetropes normal, in hyperopes shallow, and in myopia deep. If the depth of the chamber alone is responsible for the occurrence of glaucoma, why have not all hyperopes glaucoma? According to Raeder (1923)[15] the depth of the anterior chamber does not vary closely with the tension. In a previous paper[1] it was mentioned that the reason primary glaucoma is found mostly in hyperopes is probably because our population is made up mostly of hyperopes. According to Magitot and d'Antrevaux (1925),[15] the quantity of aqueous which can be abstracted from an eye with a shallow chamber is less, and Magitot (1931) and Hodgson (1938) have shown that its composition is normal. On the other hand, in acute congestive cases, the chamber is always shallow and the slit lamp reveals that the aqueous is usually cloudy due to excess protein.

It is interesting to note that Collins has shown that in cases of ophthalmomalacia, there is an edema of the iris and a coagulum in the anterior chamber.[17]

In a previous paper it was shown that myopia does not appear to have any relationship whatever to ocular hypertension.[31] It is interesting to note further that Collins (1917)[18] reveals that myopia results in

extreme hypotension due to a relaxation of the zonule and a forward displacement of the lens.

Duke-Elder[19] states that the connection between hypotony and axial myopia is well known, but that the association is not invariable. According to Lagrange (1922), about one-third of myopic eyes over —8.00 or —10.00 have a hypotension. This has been substantiated by Urio (1933) who found over a series of thirty-five markedly anisometropic cases with unilateral myopia, in 80% the eye with the high myopia had a tension lower than the fellow eye. While refractive changes in simple glaucoma may occur in the direction of myopia due probably to advancement of the lens,[20] more commonly the change is toward an *increase in hyperopia.* According to Duke-Elder, *an early and rapidly increasing presbyopia is a common and significant sign of early glaucoma.*[20]

*Conclusion:*

1. It appears quite definite that primary glaucoma is not due to drainage interference.

2. Hypertension and myopia appear to have no relationship whatever.

3. The etiology of primary glaucoma appears to originate in the aberrant behavior of the visual purple or the mechanism forming it when exposed to darkness. Since light and dark are definitely known to affect pressure changes, especially in primary glaucoma, it seems likely that the anomalous behavior of the visual purple or the mechanism forming it may be the seat of the trouble because their behavior is *dependent upon light and dark.*

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# DISSIMILAR SEGMENTS SIMPLIFIED*

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The analysis of bifocal prescriptions, particularly in cases of anisometropia, is a subject which has long intrigued the writer. During his investigations the writer has been impressed by the widespread apathy on the part of many refractionists concerning this highly important branch of optometry, despite the fact that authorities are agreed that the knowledge and application of the comparatively simple principles involved would avoid a majority of bifocal difficulties. No optometrist can afford not to know how to do this work and it is the writer's hope that the simplified technique herewith presented may, in some measure, aid in a better understanding of the subject.

While the various lens manufacturers have done excellent research work along these lines and have gone to great expense in making available to refractionists the results of their studies, the writer has felt that there still existed a need for a more simple, more easily mastered technique for dealing with these problems; a technique that would be universally applicable with all types of bifocals rather than one prepared by lens manufacturers for use particularly with lenses of their own make. The charts and technique submitted herewith are offered to the profession in the hope that better bifocal work may result.

At the risk of boring the reader who is familiar with the subject the writer feels it incumbent upon him to review a few elementary facts concerning bifocal lenses. When the distance portions of a pair of bifocals are alike in power there is no prismatic imbalance binocularly at the reading level. In anisometropia, however, the unequally powered lenses will exert unequal prismatic effects at the equal distances which the reading depths are from the centers, resulting in an artificially induced vertical phoria.

Three general methods of compensating for the prismatic imbalance

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in anisometropic bifocals are available, each having its place and value in individual cases, and to be chosen with discretion: (1) Dissimilar Segments, which may be used where the numerical value, in prism diopters, of the imbalance to be compensated is not greater than the

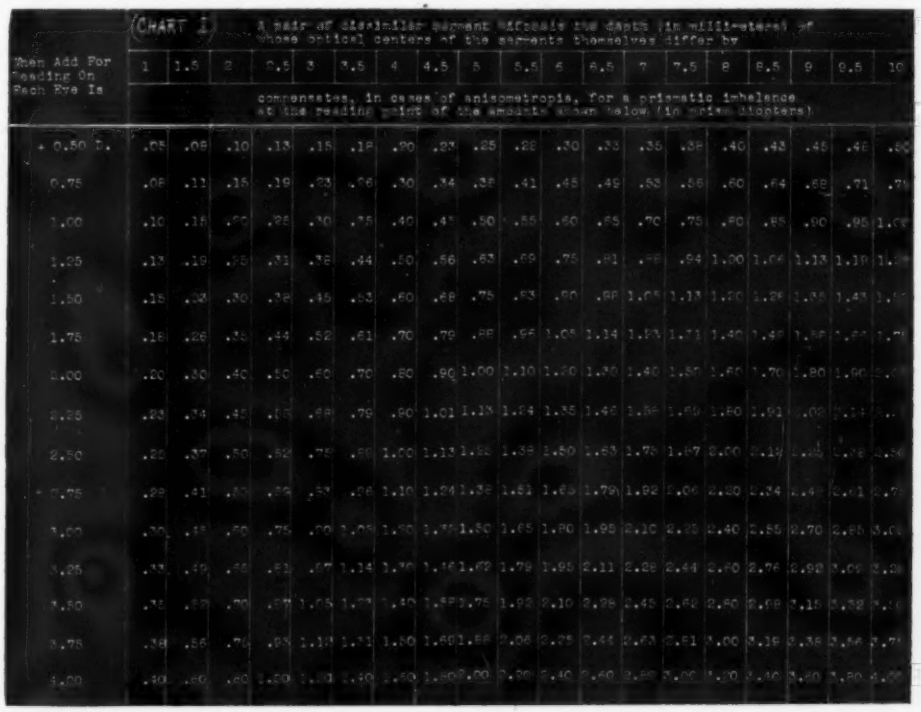

CHART 1

A pair of dissimilar segment bifocals (in millimeters) of whose optical centers of the segments themselves differ by

| When Add For Reading On Each Eye Is | 1 | 1.5 | 2 | 2.5 | 3 | 3.5 | 4 | 4.5 | 5 | 5.5 | 6 | 6.5 | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | compensates, in cases of anisometropia, for a prismatic imbalance at the reading point of the amounts shown below (in prism diopters) | | | | | | | | | | | | | | | | | | |
| + 0.50 D. | .05 | .08 | .10 | .13 | .15 | .18 | .20 | .23 | .25 | .28 | .30 | .33 | .35 | .38 | .40 | .43 | .45 | .48 | .50 |
| 0.75 | .08 | .11 | .15 | .19 | .23 | .26 | .30 | .34 | .38 | .41 | .45 | .49 | .53 | .56 | .60 | .64 | .68 | .71 | .75 |
| 1.00 | .10 | .15 | .20 | .25 | .30 | .35 | .40 | .45 | .50 | .55 | .60 | .65 | .70 | .75 | .80 | .85 | .90 | .95 | 1.00 |
| 1.25 | .13 | .19 | .25 | .31 | .38 | .44 | .50 | .56 | .63 | .69 | .75 | .81 | .88 | .94 | 1.00 | 1.06 | 1.13 | 1.19 | 1.25 |
| 1.50 | .15 | .23 | .30 | .38 | .45 | .53 | .60 | .68 | .75 | .83 | .90 | .98 | 1.05 | 1.13 | 1.20 | 1.28 | 1.35 | 1.43 | 1.50 |
| 1.75 | .18 | .26 | .35 | .44 | .52 | .61 | .70 | .79 | .88 | .96 | 1.05 | 1.14 | 1.23 | 1.31 | 1.40 | 1.49 | 1.58 | 1.66 | 1.75 |
| 2.00 | .20 | .30 | .40 | .50 | .60 | .70 | .80 | .90 | 1.00 | 1.10 | 1.20 | 1.30 | 1.40 | 1.50 | 1.60 | 1.70 | 1.80 | 1.90 | 2.00 |
| 2.25 | .23 | .34 | .45 | .56 | .68 | .79 | .90 | 1.01 | 1.13 | 1.24 | 1.35 | 1.46 | 1.58 | 1.69 | 1.80 | 1.91 | 2.03 | 2.14 | 2.25 |
| 2.50 | .25 | .37 | .50 | .62 | .75 | .88 | 1.00 | 1.13 | 1.25 | 1.38 | 1.50 | 1.63 | 1.75 | 1.87 | 2.00 | 2.13 | 2.25 | 2.38 | 2.50 |
| + 2.75 | .28 | .41 | .55 | .69 | .83 | .96 | 1.10 | 1.24 | 1.38 | 1.51 | 1.65 | 1.79 | 1.93 | 2.06 | 2.20 | 2.34 | 2.48 | 2.61 | 2.75 |
| 3.00 | .30 | .45 | .60 | .75 | .90 | 1.05 | 1.20 | 1.35 | 1.50 | 1.65 | 1.80 | 1.95 | 2.10 | 2.25 | 2.40 | 2.55 | 2.70 | 2.85 | 3.00 |
| 3.25 | .33 | .49 | .65 | .81 | .97 | 1.14 | 1.30 | 1.46 | 1.63 | 1.79 | 1.95 | 2.11 | 2.28 | 2.44 | 2.60 | 2.76 | 2.92 | 3.09 | 3.25 |
| 3.50 | .35 | .53 | .70 | .87 | 1.05 | 1.23 | 1.40 | 1.58 | 1.75 | 1.93 | 2.10 | 2.28 | 2.45 | 2.63 | 2.80 | 2.98 | 3.15 | 3.33 | 3.50 |
| 3.75 | .38 | .56 | .75 | .93 | 1.13 | 1.31 | 1.50 | 1.69 | 1.88 | 2.06 | 2.25 | 2.44 | 2.63 | 2.81 | 3.00 | 3.19 | 3.38 | 3.56 | 3.75 |
| 4.00 | .40 | .60 | .80 | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.20 | 2.40 | 2.60 | 2.80 | 3.00 | 3.20 | 3.40 | 3.60 | 3.80 | 4.00 |

numerical value, in diopters, of the reading addition; (2) Slab-Off Prism grinding, which may be used for imbalances of 1.50 prism diopters or more; (3) Prism Segments; in this writer's opinion, to be avoided wherever possible and resorted to only where correction by one of the first two methods is not feasible. The present article will concern itself entirely with the first method, dissimilar segments.

The advantages of this method, where it can be used, are ably summarized by T. H. Calkins in ESSENTIALS OF MODERN LENS THEORY AND PRACTICE published in 1941 by the *Continental Optical Company*. He states, in part, "The segments, though of different sizes, are practically invisible when worn, whereas prism segments of equal sizes have very visible shoulders. Such shoulders also tend to cause annoying reflections from overhead lighting. As the anisometropic patient can only

obtain comfortable binocular vision within a small visual zone surrounding each balanced point, the different sizes of the two segments should not bother him seriously. Dissimilar segment blanks are the regular blanks for all cases at the regular cost, whereas prism segment blanks,

| A difference in depth of the segment centers of | (CHART II) results from using the following combinations of dissimilar segment bifocals. The figure following the / sign in each case indicates the depth of the segment top below the distance optical center. |
|---|---|
| mms. 1.0 | Kryptok 22/3 / Kryptok 22/2 or Kryptok 22/3 / Kryptok 20/3 or Ultex A/3 / Ultex A/2 or Compensated Univis #5/3 / Compensated Univis #4/3 |
| 1.5 | Kryptok 22/3.5 / Kryptok 22/2 or Kryptok 22/3 / Kryptok 20/2.5 or Ultex A/3.5 / Ultex A/2 or Compensated Univis #5/3 / Compensated Univis #4/2.5 |
| 2.0 | Kryptok 22/4 / Kryptok 22/2 or Kryptok 22/3 / Kryptok 20/2 or Ultex A/3 / Ultex E/3 or Compensated Univis #5/3 / Compensated Univis #4/3 |
| 2.5 | Kryptok 22/3.5 / Kryptok 20/2 or Tillyer D/3 / Nokrome 16/2.5 or Ultex A/2.5 / Ultex E/3 or Compensated Univis #6/3 / Compensated Univis #4/2.5 |
| 3.0 | Ultex A/3 / Ultex E/3 or Kryptok 22/4 / Kryptok 20/2 or Compensated Univis #7/3 / Compensated Univis #4/3 |
| 3.5 | Ultex A/3 / Ultex E/2.5 or Ultex E/2.0 / Ultex B/3.5 or Compensated Univis #7/3 / Compensated Univis #4/2.5 |
| 4.0 | Ultex A/3 / Ultex E/2 or Ultex E/2 / Ultex B/3 or Compensated Univis #8/3 / Compensated Univis #4/3 |
| 4.5 | Ultex A/3.5 / Ultex E/2 or Ultex E/2.5 / Ultex B/3 or Compensated Univis #8/3 / Compensated Univis #4/2.5 |
| 5.0 | Ultex E/3 / Ultex B/3 or Compensated Univis #9/3 / Compensated Univis #4/3 |
| 5.5 | Ultex E/3 / Ultex B/2.5 or Compensated Univis #9/3 / Compensated Univis #4/2.5 |
| 6.0 | Ultex E/3 / Ultex B/2 or Compensated Univis #10/3 / Compensated Univis #4/3 |
| 6.5 | Ultex E/3.5 / Ultex B/2 or Compensated Univis #10/3 / Compensated Univis #4/2.5 |
| 7.0 | Ultex E/4 / Ultex B/2 or Ultex A/2 / Ultex B/3 or Compensated Univis #10/3 / Compensated Univis #4/3 |
| 7.5 | Ultex A/2.5 / Ultex B/3 or Compensated Univis #10/3.5 / Compensated Univis #4/2 |
| 8.0 | Ultex A/3 / Ultex B/3 |
| 8.5 | Ultex A/3.5 / Ultex B/3 |
| 9.0 | Ultex A/3.5 / Ultex B/2.5 |
| 9.5 | Ultex A/3.5 / Ultex B/2 |
| 10.0 | Ultex A/4 / Ultex B/2 |

being exceedingly difficult and expensive to make, entail higher costs. Dissimilar segment blanks, being regular blanks, can be taken from the regular stocks and quick service given whereas prism segment orders must be sent in to the factory and there produced by a special production order and very carefully surfaced by special prescription methods. In cases of accidental breakage, the dissimilar segment can be quickly duplicated from regular stock, whereas prism segment orders must be sent back to the factory."

Our problem was to develop a technique which would indicate at once the correct combination of dissimilar segments to balance the prismatic effects at the reading points in a pair of anisometropic bifocals, with a minimum of computation and chance for error. It had to be made so easy that the refractionist could do all of his figuring in two or three minutes at most, with the patient seated in front of him waiting to hear

CHART III) [illegible] PRISM EFFECTS OF BIFOCAL READING SEGMENTS

These prism effects are independent of and additional to those produced by the distance correction. Values given below are in prism diopters, base direction as indicated, and are computed for a reading addition of 1.00 D. For other adds, multiply value found below by power of add desired.

| Depth Of Seg Center Below Top Of Seg (mms.) | BIFOCAL | DEPTH OF READING LEVEL BELOW TOP OF READING SEGMENT (mms.) This is equivalent to depth of reading point below distance optical center minus depth of seg top below distance center. | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 3.5 | Regular Panoptik | .15 dn | .05 dn | .05 up | .15 up | .25 up | .35 up | .45 up |
| 4.0 | Ful-Vue | .20 " | .10 " | .00 | .10 " | .20 " | .30 " | .40 |
| 4.0 | Widesite A | .20 " | .10 " | .00 | .10 " | .20 " | .30 " | .40 |
| 4.0 | Compensated Univis 4 | .20 " | .10 " | .00 | .10 " | .20 " | .30 " | .40 |
| 4.5 | Univis B | .25 " | .15 " | .05 dn | .05 " | .15 " | .25 " | .35 |
| 4.5 | Ultex K | .25 " | .15 " | .05 " | .05 " | .15 " | .25 " | .35 |
| 5.0 | Univis D | .30 " | .20 " | .10 " | .00 | .10 " | .20 " | .30 |
| 5.0 | Compensated Univis 5 | .30 " | .20 " | .10 " | .00 | .10 " | .20 " | .30 |
| 5.0 | Compensated Univis 6 | .40 " | .30 " | .20 " | .10 dn | .00 | .10 " | .20 |
| 6.5 | Nokrome 13 | .45 " | .35 " | .25 " | .15 " | .05 dn | .05 " | .15 |
| 7.0 | Univis F | .50 " | .40 " | .30 " | .20 " | .10 " | .00 | .10 |
| 8.0 | Orthogon C | .60 " | .50 " | .40 " | .30 " | .20 " | .10 dn | .00 |
| 9.0 | Compensated Univis 8 | .60 " | .50 " | .40 " | .30 " | .20 " | .10 " | .00 |
| 9.0 | Compensated Univis 9 | .70 " | .60 " | .50 " | .40 " | .30 " | .20 " | .10 dn |
| 10.0 | Orthogon D | .80 " | .70 " | .60 " | .50 " | .40 " | .30 " | .20 |
| 10.0 | Tillver D | .80 " | .70 " | .60 " | .50 " | .40 " | .30 " | .20 |
| 10.0 | Widesite D | .80 " | .70 " | .60 " | .50 " | .40 " | .30 " | .20 |
| 10.0 | Kryptok 20 | .80 " | .70 " | .60 " | .50 " | .40 " | .30 " | .20 |
| 10.0 | Compensated Univis 10 | .80 " | .70 " | .60 " | .50 " | .40 " | .30 " | .20 |
| 10.5 | Kryptok 21 | .85 " | .75 " | .65 " | .55 " | .45 " | .35 " | .25 |
| 11.0 | Orthogon B | .90 " | .80 " | .70 " | .60 " | .50 " | .40 " | .30 |
| 11.0 | Tillver B | .90 " | .80 " | .70 " | .60 " | .50 " | .40 " | .30 |
| 11.0 | Ultex B | .90 " | .80 " | .70 " | .60 " | .50 " | .40 " | .30 |
| 11.0 | Kryptok, regular 22 | .90 " | .80 " | .70 " | .60 " | .50 " | .40 " | .30 |
| 11.0 | Nokrome 22 | .90 " | .80 " | .70 " | .60 " | .50 " | .40 " | .30 |
| 11.5 | Kryptok 23 | .95 " | .85 " | .75 " | .65 " | .55 " | .45 " | .35 |
| 12.0 | Kryptok 24 | 1.00 " | .90 " | .80 " | .70 " | .60 " | .50 " | .40 |
| 12.5 | Kryptok 25 | 1.05 " | .95 " | .85 " | .75 " | .65 " | .55 " | .45 |
| 13.0 | Kryptok 26 | 1.10 " | 1.00 " | .90 " | .80 " | .70 " | .60 " | .50 |
| 13.5 | Kryptok 27 | 1.15 " | 1.05 " | .95 " | .85 " | .75 " | .65 " | .55 |
| 14.0 | Kryptok 28 | 1.20 " | 1.10 " | 1.00 " | .90 " | .80 " | .70 " | .60 |
| 14.5 | Kryptok 29 | 1.25 " | 1.15 " | 1.05 " | .95 " | .85 " | .75 " | .65 |
| 15.0 | Kryptok 30 | 1.30 " | 1.20 " | 1.10 " | 1.00 " | .90 " | .80 " | .70 |
| 15.5 | Kryptok 31 | 1.35 " | 1.25 " | 1.15 " | 1.05 " | .95 " | .85 " | .75 |
| 16.0 | Ultex E | 1.40 " | 1.30 " | 1.20 " | 1.10 " | 1.00 " | .90 " | .80 |
| 16.0 | Orthogon A | 1.70 " | 1.60 " | 1.50 " | 1.40 " | 1.30 " | 1.20 " | 1.10 |
| 16.0 | Tillver A | 1.70 " | 1.60 " | 1.50 " | 1.40 " | 1.30 " | 1.20 " | 1.10 |
| 16.0 | Ultex A | 1.70 " | 1.60 " | 1.50 " | 1.40 " | 1.30 " | 1.20 " | 1.10 |

what kind of lenses he was going to wear and how much they would cost.

In analyzing a prescription for bifocals the first thing we have to do is to find out the vertical prismatic effect which each eye is subjected to when looking through the reading visual point of its respective lens, and how much these prism effects differ from one another. The reading point will differ with different individuals, but averages 8 mm. down and 2 mm. inset for convergence. We should do our computation in an orderly fashion and this is greatly facilitated by the use of a blank form such as the one illustrated in Figure 1.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Patient's Name | *Mrs. C. K.* | | | Physical Characteristics | *short arms* | | |
| Occupation | *housewife* | | | Avocations | *knitting* | | |
| RIGHT EYE | | | | Lens Size and Shape *38x42 Orbal* | LEFT EYE | | |
| PRISM EFFECT AT READING POINT | | | | Reading Point *8* mm. below distance OPTICAL center | PRISM EFFECT AT READING POINT | | |
| | △ | Base | | | | △ | Base |
| Sph. + *1.75* | *1.40* | *up* | | For prism effect of distance correction, consult tables prepared by Irving B. Lueck in Scientific and Technical Publication No. 18 of the Bausch & Lomb Optical Co. entitled "Bifocal Analysis in Anisometropia." | Sph. + *3.00* | *2.40* | *up* |
| Cyl. X | | | | | Cyl. X | | |
| Total Effect of Dist. Rx | *1.40* | *up* | | | Total Effect of Dist. Rx | *2.40* | *up* |
| Reading Add + *2.00* | *1.20* | *down* | | Prism Effect of Seg (See Chart III) | Reading Add + *2.00* | *2.20* | *down* |
| Prism Ground Into Seg | | | | If Prism Segs or Slab-off Prisms Are Used | Prism Ground Into Seg | | |
| Residual Prism Effect | *0.20* | *up* | | When Proper Compensatory Measures Have Been Taken These Will Agree Closely. | Residual Prism Effect | *0.20* | *up* |
| *Ultex B* | | | | Type of Bifocal Selected | *Ultex E* | | |
| *8* | | mm. | | Depth of Reading Point Below Center | *8* | | mm. |
| MINUS *3* | | | | Depth of Seg Top Below Center | MINUS *3* | | |
| *5* | | | | Depth of Reading Level Below Seg Top | *5* | | |
| PLUS *11* | | | | Height of Reading Level Above Lower Edge of Lens | PLUS *11* | | |
| *16* | | | | Height of Top of Seg Prescribed | *16* | | |
| P. D. *32* INSET *2* | | | | Inset for Convergence | P. D. *32* INSET *2* | | |

BROWN BIFOCAL ANALYSIS FORM FIGURE 1.

Figure 1. The Brown Bifocal Analysis Form, filled in (material in italics) for a patient requiring the following prescription: O.D. +1.75 D.Sph., O.S. +3.00 D.Sph., Add O.U. +2.00 D.Sph.

We must know the separate and distinct prismatic effects of:

(a) The spherical element of the distance correction.

(b) The cylindrical element of the distance correction.

(c) The reading segment itself.

It will be seen at once that whereas (a) and (b) are constants, (c) however permits of variation depending upon the type of bifocal segment chosen for each eye. Chart III shows in detail the extent of this variation. Therein lies the whole secret of compensation by dissimilar segments.

Values for (a) and (b) need not be computed but may be found in the excellent tables prepared by Irving B. Lueck in SCIENTIFIC AND TECHNICAL PUBLICATION NO. 18, published by the *Bausch & Lomb Optical Company*. These tables are indispensable and the reader is strongly urged to secure a copy. *The Univis Corporation* also supplies a good set of tables prepared by Virgil Hoyt Hancock.

Having found the difference in prism effects induced by the two different distance corrections we now consult Chart I, to find out how much of a difference in depth of segment centers our dissimilar segments must have to compensate for the imbalance. Then, turning to Chart II, we find, alongside this difference, the combinations we must use. In most cases there is a choice of combinations. Choose the combination you like best, guiding yourself by such considerations as the patient's vocation and avocations, habitual posture, and the cost of the various lenses.

Which segment do you use on which eye? Look at your data and note the total prism effect, on each eye, of the distance prescription. Place the seg with the deepest center (you can check this on Chart III), on the eye that needs the greatest amount of base-down prism.

Now, to make your figures complete, and as a check on the accuracy of your work, consult Chart III and fill in for each eye on your analysis form, the prismatic effect of the segment you have selected. Your totals on both sides, the residual prismatic effects, will be found to agree very closely.

Let's try an example (see Figure 1) and see how easy it is.

Rx R. +1.75
L. +3.00
Add O. U. +2.00, 38×42 Orbal, reading depth 8 mm.

Consulting our Bausch & Lomb tables we find that the total prismatic effect of the distance correction at the reading depth of 8 mm. is, for the right eye 1.40 base-up, for the left eye 2.40 base-up, a difference of 1.00 prism diopters. From Chart I, we find that to compensate for a 1.00 imbalance with a 2.00 D. add we will need a pair of dissimilar segment bifocals, the depth of whose segment centers differ by 5 mm.

Now, turning to Chart II, we find that we may secure this 5 mm. difference by using Ultex E/3 on one eye and Ultex B/3 on the other, or we may use a Compensated Univis No. 9/3 and a Compensated Univis No. 4/3. Either combination will serve but we happen in this case to select the Ultex combination. The Ultex E has the deepest segment center, as we learn from Chart III, so, remembering our rule, we place it on the left eye which needs the greater amount of base-down prism. Now, again consulting Chart III, we find that the prismatic effect of an Ultex B segment, when the reading depth is 5 mm. below the segment top (8—3=5), is 0.60 base-down for a +1.00 add. Since our add is +2.00, we multiply 0.60 by 2.00 and obtain 1.20 base-down as the prismatic effect of the seg itself on the right eye. Similarly we find that 2.20 base-down is the prismatic effect of the Ultex E seg on the left eye. Adding on both sides, we obtain a net or residual prismatic effect of 0.20 base-up on the right eye and an exactly equal amount on the left eye, thus proving that our imbalance has been neutralized.

The writer regrets that space limitations forbid illustration with further examples. The reader should, however, apply the above technique to examples of his own choice for study purposes. In this way the reader will learn by doing, and in so doing will prepare himself to cope with actual problems which will come his way. Do not, however, attempt to check or work these problems without the aid of the Bausch & Lomb tables. To do so is difficult, even if you are exceptionally well versed in mathematics, and defeats our purpose to make this work simple and rapid. The prismatic effect of the spherical element of the distance correction or of cylinders at axis 90° or 189° may, of course, be easily figured out by Prentice's Law of decentration. But oblique cylinders are more difficult and therefore one should use the tables. These are based on an inset for convergence of 2 mm., but in most cases, the values therein are affected to a negligible degree only, by slight alterations in the amount of inset.

One point in connection with Chart II may need some additional clarification. The figure following the "/" sign in each case indicates the depth of the segment top below the distance optical center. These segment depths are not mandatory, only their relationship to one another is of importance and must be maintained as given in the chart. For example, if the combination shown on the chart is $\frac{\text{Ultex E/3,}}{\text{Ultex B/2}}$

the reader may, if he finds it necessary, use $\frac{\text{Ultex E/4}}{\text{Ultex B/3}}$ or $\frac{\text{Ultex E/2}}{\text{Ultex B/1}}$ with equally good results.

Another point; we must have a definite understanding with the laboratory so that we need never be in doubt as to where the distance optical center will be placed in any lens pattern. To avoid confusion and for best all around results the writer recommends that the distance field optical center should in every case coincide with the geometric center of the lens. When this is a standing order there will be no doubt that in a lens that is 40 mms. high the distance optical center is 20 mms. high, and our calculations will be easier and less subject to error.

Today, with so many older workers engaged in defense industry on jobs requiring sustained comfortable near vision, refractionists owe it to their patients as well as to themselves to neglect no opportunity to give these men and women the best eyesight possible.

DR. J. J. BROWN
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PERTH AMBOY, N. J.

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## A TEST FOR BLACKOUT VISION

The Refractionist of London in its February, 1941 issue, describes a test which under our present conditions might be found useful in testing wardens and other persons for dark adaptation or more explicitly for their ability to discern objects under feeble illumination. The device is of simple construction and could be manufactured in large quantities for use by civilian defense groups.

The instrument, known as Dr. Wright's Test for Night Vision, consists of a wooden base on which are hinged, to permit folding, a source of illumination and at the opposite end, at a fixed distance, a test card holder.

The light source consists of a disc of luminous radium compound

and is not seen by the testee, but throws a faint glow on the test cards. The test cards are numbered from one to nine in degrees of difficulty. They are of black board, on each one of which is printed Landolt's broken ring in increasing stages of grays until number nine has but little contrast with the background.

The apparatus is used in a dark room and the procedure is as follows: (1) The testee is previously dark adapted for fifteen minutes to bring about a state of dark adaptation roughly corresponding to night vision. (2) The cards are presented from number 1 to 9 with the break in varying positions until the limit of resolving power has been determined.

According to the Refractionist, tests on 300 persons show that 49 per cent could see card number 7, 23 per cent could see number 8, 20 per cent could only see number 6, 6½ per cent could see number 5 or less, while ½ of 1 per cent could see number 9, thus making 7 the mean for the group.

It was also found that persons under twenty years of age can see one card darker than those persons over thirty.

The size of the Landolt circle selected on the design and the fact that the test can be made at any distance from the patient's eyes permits the elimination of visual acuity as a factor. While more accurate adaptation tests can be made on the basis of time, the Wright test seems to offer a simple and inexpensive method of testing vision under low illumination, for our volunteers in civilian defense.

G. L. Du Plessis.

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## ON THE NATURE OF A POLISHED GLASS SURFACE

An interesting article with the above title suggests that optometric familiarity with lenses should extend beyond the power of the lens on to the nature of the surface. It is popularly believed that glass polished surfaces are produced by the use of successively fine abrasives obliterating the peaks until the bottom of the deepest declevity has been reached. There is then no more roughness and the result is a smooth polished surface, without pits or scratches. This is not true.

Glass is amorphous and has no crystalline structure and according

to Lloyd Motz,[1] the polishing process is a flowing over of the high material into the depressions resulting in a new molecular structure.

This newly arranged molecular layer has definite thickness and in the case of calcite, a crystal, it is stated as being 50 angstrom units in thickness. This can be determined because in the case of polished crystalline substances, the amorphous layer can be dissolved by acid until the crystalline structure is reached. In glass, however, both layers being amorphous it is difficult to determine where one ends and the other begins. Motz, however, demonstrated that the same condition exists by tracing, with a razor, faint scratches of definite pattern on a highly polished hard crown surface. The surface was then polished again until no trace of the scratches could be seen under a microscope. The surface was then placed in a very weak solution of hydrofluoric acid whereupon after a few minutes all the razor edge scratches reappeared more prominently than ever. This demonstrates that polishing as it is practiced in optical laboratories is not a grinding or wearing down process but a removal of the high spots of glass to the lowest spots until all microscopic roughness has disappeared.

Because of the action of acid on the surface layer, it is reasonable also to assume that lenses unprotected from contamination eventually deteriorate with age. However, this surmise is purely theoretic because it has been shown that alteration of a lens surface layer to a thickness less than one wavelength improves light transmission properties of the glass by decreasing surface reflection loss. This lens coating process, as it is called, by weak acid is used commercially in camera lenses, and it has been found that the acid treatment given is insufficient to destroy the surface layer and yet by interference decreases the reflectivity of that surface layer and increases the amount of light transmitted by the glass.

Thus another misconception about lenses, based on a lack of observation, is blown to bits. Would that our many other misconcepts were so easily corrected.

G. L. DU PLESSIS.

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[1]On the Nature of a Polished Surface, Lloyd Motz—Journal of Optical Society of America. March, 1942.

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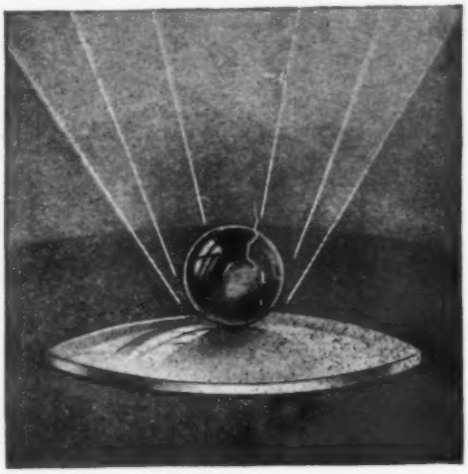

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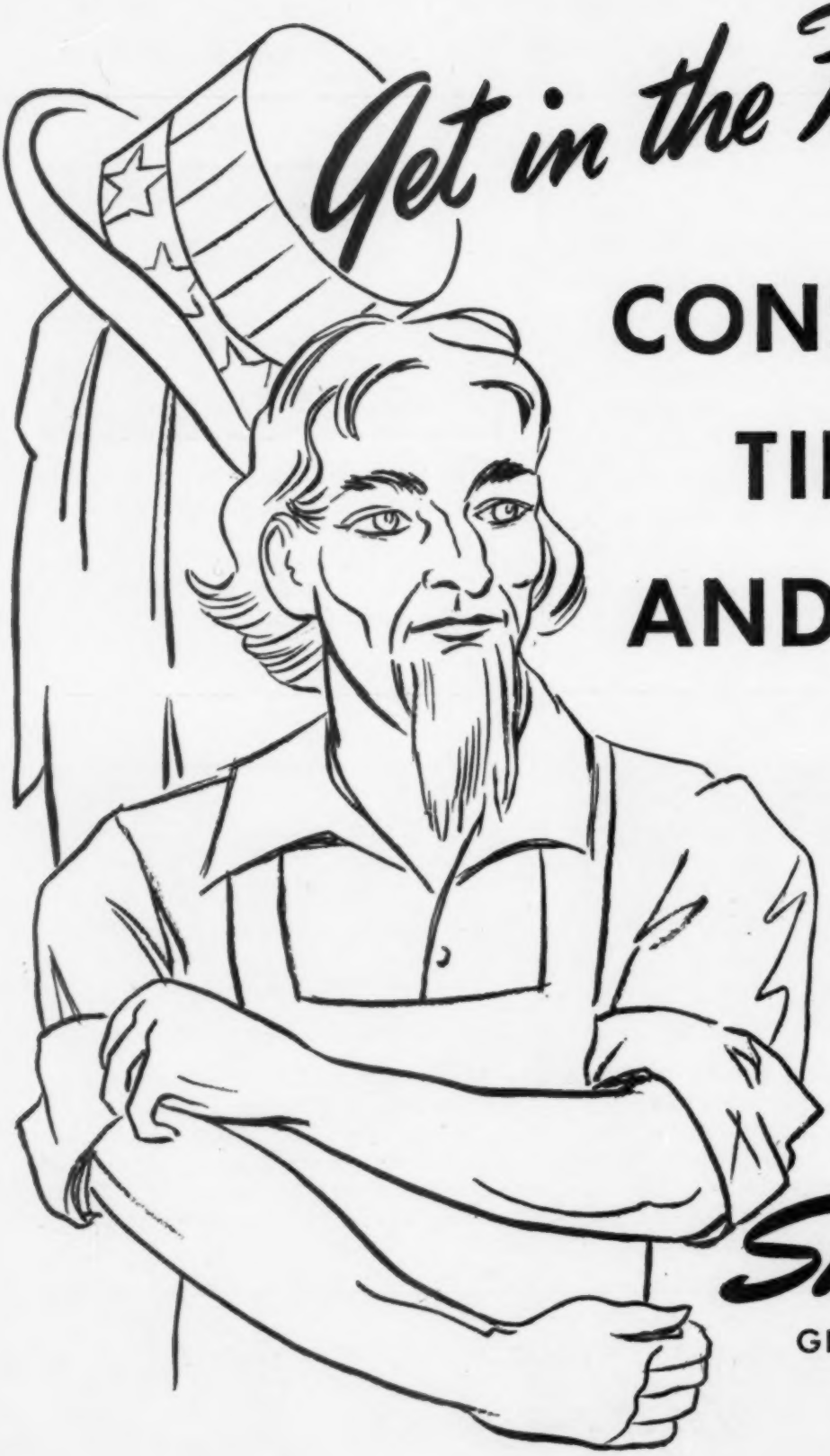

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